

**What is claimed is:**

1. An optical transmission system where one or a plurality of Raman amplifiers are positioned on an  
5 optical transmission line, wherein:
  - each of the Raman amplifiers comprises  
a plurality of pump light sources producing  
pump lights for Raman amplification, and  
a multiplexer multiplexing the pump lights  
10 produced by the plurality of pump light sources and  
providing a multiplexed pump light to the transmission  
line; and  
a gain equalizer is arranged on the transmission  
line.
- 15 2. The optical transmission system according to claim  
1, wherein  
a gain wavelength characteristic of the gain  
equalizer is fixed.
- 20 3. The optical transmission system according to claim  
1, wherein  
a gain wavelength characteristic of the gain  
equalizer is dynamically adjusted so that a gain of the  
25 optical transmission system becomes a predetermined

value.

4. An optical transmission system where a plurality  
of Raman amplifiers are positioned on an optical  
5 transmission line, and each of the Raman amplifiers uses  
a plurality of pump lights, wherein

when power of a pump light having a first wavelength  
among the plurality of pump lights drops to a  
predetermined level or lower in a first Raman amplifier  
10 among the plurality of Raman amplifiers, power of a pump  
light having the first wavelength or a wavelength that  
is substantially the same as the first wavelength is  
raised in one or some of the plurality of Raman amplifiers  
other than the first Raman amplifier.

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5. An optical transmission system where a plurality  
of Raman amplifiers are positioned on an optical  
transmission line, and each of the Raman amplifiers uses  
a plurality of pump lights, wherein  
20 when power of a pump light having a first wavelength  
among the plurality of pump lights drops to a  
predetermined level or lower in a first Raman amplifier  
among the plurality of Raman amplifiers, power of a pump  
light having a wavelength adjacent to the first  
25 wavelength is raised in the first Raman amplifier or

another Raman amplifier.

6. An optical transmission system where a plurality  
of Raman amplifiers are positioned on an optical  
5 transmission line, wherein

a transmission loss of an optical transmission line  
between a first Raman amplifier and a second Raman  
amplifier that is adjacent to the first Raman amplifier  
among the plurality of Raman amplifiers increases, power  
10 of a pump light is raised at least in the first and the  
second Raman amplifiers.

7. An optical transmission system where a plurality  
of Raman amplifiers are positioned on an optical  
15 transmission line, wherein

a transmission loss of an optical transmission line  
between a first Raman amplifier and a second Raman  
amplifier that is adjacent to the first Raman amplifier  
among the plurality of Raman amplifiers increases, power  
20 of a pump light to be provided to a transmission line  
other than the transmission line between the first and  
the second Raman amplifiers is raised.

8. An optical transmission system where a plurality  
25 of Raman amplifiers are positioned on an optical

transmission line, and each of the Raman amplifiers uses a plurality of pump lights, wherein:

each of the Raman amplifiers comprises a multiplexer multiplexing the plurality of pump lights,  
5 and providing a multiplexed pump light to the optical transmission line; and

an average of characteristics of a plurality of multiplexers that are arranged in the plurality of Raman amplifiers becomes a predetermined characteristic.

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9. The optical transmission system according to claim 8, wherein

the multiplexers are selected and arranged so that the average of the characteristics of the plurality of  
15 multiplexers becomes a predetermined characteristic every predetermined number of Raman amplifiers.

10. The optical transmission system according to claim 9, wherein

20 if the optical transmission line accommodates "m" optical fibers, the predetermined number is "m" or an integer multiple of "m".

11. The optical transmission system according to claim  
25 4, wherein:

the optical transmission line accommodates "m" optical fibers; and

"m" pump lights having different wavelengths are multiplexed in each of the Raman amplifiers, and a 5 multiplexed pump light is respectively provided to the "m" optical fibers.

12. The optical transmission system according to claim 4, wherein:

10 the optical transmission line accommodates "m" optical fibers;

each of the Raman amplifiers comprises a multiplexer having "m" input ports and "m" output ports;

a polarization-coupled light that is obtained by 15 polarization-coupling two pump lights is input to each of the "m" input ports; and

the multiplexer multiplexes the polarization-coupled lights input via the "m" input ports, and respectively provides a multiplexed light to the 20 "m" optical fibers.

13. The optical transmission system according to claim 4, wherein:

each of the Raman amplifiers comprises a 25 multiplexer multiplexing a plurality of pump lights,

and providing a multiplexed pump light to the optical transmission line;

a plurality of multiplexers are selected and arranged so that an average of characteristics of the 5 multiplexers comprised by a predetermined number of Raman amplifiers becomes a predetermined characteristic every predetermined number of Raman amplifiers; and

power of a pump light is raised in the predetermined number of Raman amplifiers.

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14. The optical transmission system according to claim 7, wherein

when an amount of increase in the transmission loss of the optical transmission line is "L", and the number 15 of Raman amplifiers where power of a pump light is to be raised is "a", the pump light is adjusted so that an amount of a gain increased by each of the "a" Raman amplifiers is "L/a".

20 15. An optical transmission method with which a plurality of Raman amplifiers are positioned on an optical transmission line between a first optical terminal station and a second optical terminal station, and each of the Raman amplifiers uses a plurality of 25 pump lights, wherein:

power of each of the plurality of pump lights in the plurality of Raman amplifiers is detected by the first optical terminal station;

when power of a pump light having a first wavelength among the plurality of pump lights drops to a predetermined level or lower in a first Raman amplifier among the plurality of Raman amplifiers, a control signal for raising power of a pump light having the first wavelength or a wavelength that is substantially the same as the first wavelength is transmitted from the first optical terminal station to one or some of the plurality of Raman amplifiers other than the first Raman amplifier; and

pump light is adjusted in accordance with the control signal in the one or some of the plurality of Raman amplifiers.

16. An optical transmission method with which a plurality of Raman amplifiers are positioned on an optical transmission line between a first optical terminal station and a second optical terminal station, and each of the Raman amplifiers uses a plurality of pump lights, wherein:

power of each of the plurality of pump lights in the plurality of Raman amplifiers is detected by the

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first optical terminal station;

when power of a pump light having a first wavelength among the plurality of pump lights drops to a predetermined level or lower in a first Raman amplifier

5 among the plurality of Raman amplifiers, a control signal for raising power of a pump light having a wavelength adjacent to the first wavelength is transmitted from the first optical terminal station to the first Raman amplifier; and

10 the pump light is adjusted in accordance with the control signal in the first Raman amplifier.